

METHOD AND APPARATUS FOR THE MANUFACTURE
OF SHEET-LAMINATED ALUMINUM PROFILE

BACKGROUND OF THE INVENTION

5 1. Field of the Invention:

This invention relates to a technique for the union between an aluminum profile and a sheet material, and more particularly relates to a method for the manufacture of an aluminum profile having a resin sheet material laminated thereon and an apparatus to be used therefor. The term "aluminum profile(s)" is used herein to express the shape(s) or section(s) made of aluminum or an aluminum alloy.

2. Description of the Prior Art:

15 The sheet-laminated aluminum profiles having a resin sheet material laminated on the surface of a profile made of aluminum or an aluminum alloy have been used in various technical fields because they are light and excellent in durability, strength, appearance, or the like.

20 Generally, aluminum profiles to be used as a building material etc. are predominantly used in such a state that they have been coated with an anodic oxide film or a composite coating of anodic oxide film/coating film for the purpose of imparting a fine appearance and corrosion resistance thereto. Further, for the purpose of increasing a design-effect, the profiles which have a resin decorative sheet having a grain pattern, a geometrical pattern, or other pattern laminated on the anodic oxide film or the composite coating of anodic oxide film/coating film are put in practical use (see, for

example, Japanese Patent Applications, KOKAI (Early publication) No. 10-157006, No. 61-19337, and No. 59-123656).

Heretofore, in the manufacture of sheet-laminated aluminum profiles, a sheet material is continuously laminated on a plurality of aluminum profiles being conveyed and a portion of the sheet material between aluminum profiles is cut with a cutting device, such as a rotary cutting saw blade, a guillotine cutter, and a disk type rotary cutter to form sheet-laminated aluminum profiles.

10 In this case, when a sheet material is continuously laminated on the profiles which are conveyed in such a state that there is no space between the profiles of continuous lengths, cutting of the profile end and the sheet material is simultaneously performed because the cutting of the sheet material only is hardly possible.

15 On the other hand, when the sheet material is laminated continuously on the profiles which are conveyed while leaving a space between the profiles, it is hardly possible to cut only the sheet material exactly at an end face of the profile with sufficient accuracy. As a result, the uncut rim-like portion of the sheet material remains in the profile end and the cut ends of the profiles are uneven. Also in this case, therefore, it is necessary to cut both ends of the profile with an automatic cutting machine.

25 In either case mentioned above, therefore, the cutting of the profile ends is needed and the yield becomes low accordingly. Further, there is a problem that the products and the production line are soiled by the cuttings (cutting

dust) of a base material produced by the cutting. Moreover, when the sheet materials are laminated on the profiles twice or more, for example on the obverse and on the reverse of the profile, there is another problem that the cutting dust
5 adheres to the sheet material which has been laminated first, thereby obstructing the manufacture of the sheet-laminated profiles.

SUMMARY OF THE INVENTION

10 It is, therefore, an object of the present invention to develop a technique for cutting only a sheet material relatively simply with high accuracy, without cutting a profile, in the manufacture of a sheet-laminated aluminum profile by continuously laminating a sheet material on a
15 plurality of aluminum profiles being conveyed and, therefore, to provide a method and an apparatus for the manufacture of a sheet-laminated aluminum profile having a resin sheet material integrally laminated on the surface of the profile at a low cost with high productivity, without causing such
20 problems as occurrence of cutting dust and defective products.

A further object of the present invention is to develop a technique for improving the adhesiveness between a profile and a resin sheet material and continuously performing
25 accurate cutting of a sheet material only by a relatively simple and inexpensive process and, therefore, to provide a method and an apparatus for the manufacture of a sheet-laminated aluminum profile comprising a profile and a resin

sheet material integrally joined fast to each other at a low cost with high productivity, without causing such problems as occurrence of cutting dust and defective products.

To accomplish the objects described above, a first aspect
5 of the present invention provides a method for the manufacture of a sheet-laminated aluminum profile. A fundamental embodiment thereof is characterized by the steps of continuously laminating a sheet material on a plurality of aluminum profiles and cutting the sheet material at a position
10 between the aluminum profiles mentioned above by an electric discharge cutting treatment to form the sheet-laminated aluminum profile.

In a preferred embodiment, when the sheet material is cut by an electric discharge cutting treatment, the cutting
15 is performed while applying a tension stress to a portion of the sheet material to be cut. One concrete embodiment for performing this operation is to set the conveyance speeds of aluminum profiles before and after the cutting at such a ratio that the conveyance speed of the aluminum profile in the
20 downstream side is higher than the conveyance speed of the aluminum profile in the upstream side in the step of cutting the sheet material by an electric discharge cutting treatment.

In another preferred embodiment of the method for the
25 manufacture of a sheet-laminated aluminum profile which exhibits increased adhesive strength between a profile and a resin sheet material, the aluminum profile mentioned above is a coated aluminum profile and this aluminum profile is

subjected to the surface modification by an electric discharge treatment and then to the lamination of a sheet material. More preferably, the surface of the aluminum profile mentioned above is subjected to the surface
5 modification by an electric discharge treatment, a surface portion of the aluminum profile on which an edge portion of the sheet material is to be laminated is subjected to a local electric discharge treatment, and then a sheet material is laminated on the profile.

10 The profile to be effectively used in this method may be a profile having a coating film formed by a coating treatment on the surface of a profile of aluminum or an aluminum alloy, usually an extruded profile, or a profile having formed thereon a composite film comprising an anodic
15 oxide film, a colored oxide film, or a chemical conversion film and a coating film superposed thereon. Thus, a profile furnished on the surface thereof with a coating film is invariably usable for the method mentioned above. The coating treatment involved herein may be performed by any of
20 the heretofore known methods such as, for example, electrodeposition coating, immersion coating, and electrostatic coating.

In accordance with a second aspect of the present invention, there is provided an apparatus for the manufacture
25 of a sheet-laminated aluminum profile. A fundamental embodiment thereof is characterized by comprising a conveying means for conveying aluminum profiles, a sheet material supplying means for continuously supplying a sheet material

to a plurality of aluminum profiles being conveyed, a means for laminating the sheet material on surfaces of the aluminum profiles, an electric discharge cutting device for cutting the sheet material laminated on the plurality of aluminum profiles at a position between the aluminum profiles.

In accordance with a preferred embodiment, the conveying means mentioned above comprises an upstream side conveying means and a downstream side conveying means disposed respectively before and behind the electric discharge cutting device and is capable of regulating the conveyance speed of the downstream side conveying means to be higher than the conveyance speed of the upstream side conveying means.

In another preferred embodiment of the apparatus for the manufacture of a sheet-laminated aluminum profile which is capable of increasing the adhesive strength between a profile and a resin sheet material, the conveying means mentioned above further comprises a conveying means for supplying profiles disposed on the upstream side of the sheet material supplying means, and an electric discharge treatment unit for performing the surface modification of coated aluminum profiles is disposed over a transfer line of the conveying means for supplying profiles. More preferably, the electric discharge treatment unit for performing the surface modification of the coated aluminum profiles comprises an electric discharge surface treatment unit for performing modification of a surface of the coated aluminum profile and a local electric discharge treatment unit for performing modification of a surface portion of the coated aluminum

profile on which an edge portion of the sheet material is to be laminated.

BRIEF DESCRIPTION OF THE DRAWINGS

5 Other objects, features, and advantages of the invention will become apparent from the following description taken together with the drawings, in which:

10 Fig. 1 is a schematic side view illustrating a schematic construction of one embodiment of an apparatus for the manufacture of a sheet-laminated aluminum profile according to the present invention;

15 Fig. 2 is a fragmentary schematic perspective view illustrating an essential part of the apparatus for the manufacture of a sheet-laminated aluminum profile shown in Fig. 1;

 Fig. 3 is a fragmentary schematic perspective view illustrating the state after cutting of a sheet material of a sheet-laminated aluminum profile by an electric discharge cutting treatment;

20 Fig. 4 is a diagram illustrating a schematic construction of one example of a device for corona discharge treatment;

 Figs. 5 is a schematic explanatory diagram illustrating a surface modification process of a coated aluminum profile by an electric discharge treatment;

25 Fig. 6 is a schematic cross-sectional view illustrating one example of an electric discharge sheet cutter;

 Figs. 7 is a schematic explanatory diagram illustrating a sheet material cutting process of a sheet-laminated

aluminum profile by an electric discharge cutting treatment;
and

Fig. 8 is a schematic cross-sectional view illustrating
one example of a sheet-laminated aluminum profile.

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DETAILED DESCRIPTION OF THE INVENTION

The manufacture of a sheet-laminated aluminum profile
according to the present invention is characterized by the
steps of continuously laminating a sheet material on a
10 plurality of aluminum profiles and cutting the sheet material
at a position between the aluminum profiles mentioned above
by an electric discharge cutting treatment to form the
sheet-laminated aluminum profile, as described above.

Specifically, the sheet material is cut by virtue of
15 thermal energy by the electric discharge cutting treatment,
without using a mechanical cutting device to be used in the
conventional method. As a result, the following functions
and effects can be obtained.

(1) Only the sheet material can be cut, without damaging the
20 aluminum profile and the sheet material laminated on the
surface thereof.

(2) Only the sheet material can be cut even if there is no
gap between the profiles.

(3) Since only the sheet material is cut by virtue of thermal
25 energy, there is no occurrence of cutting dust and no soilure
of products and the production line. Even when the sheet
materials are laminated on the profiles twice or more, the
subsequent lamination of the sheet material is not affected

because there is no adhesion of cutting dust to the sheet material which has been laminated first.

(4) Since the cutting operation can be performed by setting the gap between the aluminum profiles at a small value, in the subsequent step of cutting the aluminum profile to a fixed size, the cutting line is scarcely deviated from a reference.

(5) Since an edge tool is not used, the sheet material can be cut even if it is in a three-dimensional form laminated on a large-sized profile or a curved surface.

(6) Since a series of steps can be automated, reduction in work force and in production cost can be attained.

In a preferred embodiment that the sheet material is cut by means of the electric discharge cutting treatment while applying a tension stress to a portion of the sheet material to be cut, the cutting can be done in a short time without exerting the thermal influence on the sheet material. In this case, when the sheet material is cut by the electric discharge cutting treatment in such a manner that the conveyance speeds of aluminum profiles before and after the cutting are set at such a ratio that the conveyance speed of the aluminum profile in the downstream side is higher than the conveyance speed of the aluminum profile in the upstream side, the cutting of the sheet material can be done while continuously conveying the profiles. This feature is advantageous in view of the productivity.

Further, in another preferred embodiment of the method for the manufacture of a sheet-laminated aluminum profile which exhibits increased adhesive strength between a profile

and a resin sheet material, the aluminum profile mentioned above is a coated aluminum profile, and this aluminum profile is subjected to the surface modification by an electric discharge treatment and then to the lamination of a sheet material.

By performing an electric discharge treatment on a coated aluminum profile prior to the lamination of a sheet material as described above, the chemical bonds between the resin molecules forming a coating film on the surface of the profile are severed by the discharge energy or liberated electrons etc., and free hydrophilic functional groups such as, for example, -OH, -COOH, =NH, -NH₂, -SH, -SOH, or -NHCO- are formed, depending on the kind of coating material used, with the result that the surface of the coating film will acquire improved wettability for a resin and the adhesive strength between the resin sheet material and the profile considerably increases.

In a more preferred embodiment, the surface of the aluminum profile mentioned above is subjected to the surface modification by an electric discharge treatment, a surface portion of the aluminum profile on which an edge portion of the sheet material is to be laminated is subjected to a local electric discharge treatment, and then a sheet material is laminated on the profile. By performing the local electric discharge treatment on the portion of the aluminum profile on which the edge portion of the sheet material is to be laminated, strong lamination of the otherwise easily peelable edge portion of the sheet material on the profile can be

attained.

When the surface modification treatment mentioned above is carried out, it is necessary to use an aluminum profile which has been subjected to a coating treatment. If the surface modification treatment is not carried out, however, both an uncoated aluminum profile and a coated aluminum profile may be used. When the surface modification treatment is carried out, the coating film on the surface of the profile is only required to be capable of forming such a hydrophilic functional group as mentioned above in consequence of the electric discharge treatment. As concrete examples of the coating film answering this description, the coating films which result from applying an acrylic resin coating material, an acryl-melamine resin coating material, a polyester coating material, a polyurethane coating material, a melamine resin coating material, an acryl-silicone resin coating material (having two or more fluorine atoms bound to a silane group) by such a coating method as electrodeposition coating, immersion coating, or electrostatic coating may be cited.

As concrete examples of the method for performing the electric discharge treatment for the surface modification of the coated aluminum profile, (1) a method which comprises performing a corona discharge on a given coating film at normal room temperature under normal pressure thereby effecting a surface treatment of the coating film (corona discharge treatment), (2) a method which comprises performing a glow discharge on a given coating film in a vacuum thereby treating the surface of the coating film (ionic treatment),

and (3) a method which comprises performing a glow discharge on a given coating film in a vacuum containing a trace quantity of a monomer and an inert gas thereby effecting the surface modification of the coating film (plasma treatment) may be cited. These methods are invariably capable of modifying the surface of the coating film of a profile by virtue of electric energy. Among other methods mentioned above, the method of corona discharge treatment which can be carried out rather simply at normal room temperature under normal pressure at a low cost proves to be particularly advantageous. The treating devices available for the corona discharge treatment are broadly known in three types, i.e. a spark gap system, a vacuum tube system, and a solid state system. For the electric discharge treatment contemplated by the present invention, any of these systems can be effectively adopted.

The conditions for the electric discharge treatment are preferred to be set such that the surface of the coating film of a discharge treated profile registers a surface tension of not less than 45 dyn/cm or causes 5 μ l of a water drop poured thereon to spread over an area of not less than 3.5 cm, preferably not less than 3.7 cm, in diameter. These conditions can be adjusted, for example, by suitably setting the speed of conveyance of the profiles or the magnitude of discharge voltage or other discharge conditions.

Now, the present invention will be described more concretely below by explaining the preferred embodiments shown in the annexed drawings.

Fig. 1 through Fig. 3 show the schematic construction

of an apparatus for the manufacture of a sheet-laminated aluminum profile which can perform continuously a series of steps of the surface modification of a coated aluminum profile, the lamination of a sheet material thereon, 5 automatic cutting of the sheet material by an electric discharge cutting treatment, and the discharge of products.

First, the flow of the steps will be described roughly. An aluminum profile 1 which is in motion on a profile supply conveyor 2 enters in a corona discharge treatment unit 10 and 10 a surface modification treatment of a coating film thereof is performed herein. Thereafter, the sides of the aluminum profile on which the edges of a sheet material is to be laminated is subjected to a local electric discharge treatment by a local electric discharge treatment unit 20.

15 The aluminum profile 1 which has undergone the surface modification as mentioned above is subsequently transferred to a lamination unit 30 and in a heating section 31 herein firstly heated to a temperature suitable for the lamination of a sheet material. The heating temperature can be suitably 20 set depending on the kind of the sheet material to be laminated or an adhesive. On the other hand, during a sheet material 41 supplied from a sheet roll 42 of a sheet material supply device 40 is coated with an adhesive while passing through an adhesives tank 43 and supplied to a sheet shaping section 25 32, the applied adhesive will assume the state of having adequate tackiness. The sheet material 41 of this state is supplied to the sheet shaping section 32, laminated on the aluminum profile 1 during the aluminum profile passes through

the shaping section 32, and shaped under pressure by upper pressure rollers 35 and side pressure rollers 36 which are arranged in the shaping section 32 so that the sheet material 41 may closely adhere to the aluminum profile 1. Then, the sheet material 41 is heated under pressure by an upper heating pressure roller 37 and a pair of side heating pressure rollers 38 which are arranged in a pressure adhesion section 33 to effect lamination on the aluminum profile 1 (see Fig. 2). In the drawing, although the upper pressure rollers 35 are illustrated as having the same width as that of the aluminum profile 1, it is desirable that the upper pressure rollers 35 should have a width larger than that of the aluminum profile 1 and the roller surface should be elastic, in view of the subsequent lamination of the sheet material 41 on the side part and the edge part of the aluminum profile 1 with the side pressure rollers 36.

Thereafter, the sheet material 41 is cut by the electric discharge cutting treatment at a position between the aluminum profiles 1 by means of electric discharge sheet cutters 51 in an automatic sheet cutting unit 50 (see Fig. 3) to form the sheet-laminated aluminum profile 1a.

In the above step, when the cutting of the sheet material is performed in such a manner that the speed of conveyance of the downstream side aluminum profile by means of carrying rollers 4 of a product discharge conveyor 3 which is a downstream side conveying means is higher than the speed of conveyance of the upstream side aluminum profile by means of carrying rollers 34 which are conveying means disposed on the

upstream side of the electric discharge cutting treatment and arranged in the lamination unit 30, the cutting is performed while applying a tension stress to a portion of the sheet material 41 to be cut and the cutting can be done in a short time without exerting thermal influence on the sheet material. The sheet material can be cut with sufficient accuracy at the end face of the profile if the distance between the aluminum profiles 1 is several mm or less. Even if the distance exceeds such a value, however, the remainder of the sheet material after cutting of not more than about 3mm extending from the end of the profile will not cause any problem. Usually, it is acceptable if the sheet material can be cut at one end of the profile with high accuracy. The preferred distance between the aluminum profiles 1 is about 1mm.

Next, the main steps in the manufacture of the sheet-laminated aluminum profile of the preferred embodiment mentioned above will be described with reference to the drawings.

Fig. 4 illustrates the corona discharge treatment unit for performing the surface modification treatment on the aluminum profile 1 which is in motion on the profile supply conveyor 2 of the roller conveyor type.

Electrodes 11 comprising a multiplicity of wires bundled are fitted to an elevating plate 13 through the medium of a porcelain insulator 12 and the periphery of the electrodes 11 is enclosed with an electrode cover 14 made of a synthetic resin and fitted to the elevating plate 13. The reference

numeral 15 represents an electrode gap adjuster for adjusting the distance between the leading terminals of the electrodes 11 and the aluminum profile 1. The profile supply conveyor 2 is provided in the part thereof falling directly below the electrodes 11 with a metallic drive roller 16a coated with a dielectric material, which is connected to the grounding side of a high-frequency oscillator 17. The electrodes 11 are connected to a high-voltage transformer 18 through the medium of the high-voltage lead wire. When the corona discharge is generated by the application of a high voltage between the electrodes 11 and the aluminum profile 1 held in contact with the metallic drive roller 16a, therefore, the corona discharge treatment is continuously performed on the surface of the aluminum profile 1 which is in motion on the profile supply conveyor. The other carrying rollers 16b used in the profile supply conveyor are rollers lined with rubber. The speed of conveyance of the profile can be suitably adjusted. The high-frequency power source for the corona discharge has a frequency generally in the range of 8,000 - 35,000 Hz, preferably below 10,000 Hz, and a voltage thereof is desired to be not less than 0.5 kV and not more than 3 kV.

Incidentally, the corona discharge treatment is effected at a high frequency and a high voltage. The high-voltage part, when approached by a human body, has the possibility of emitting a spark and burning the skin of the human body. For preventing this accident, the electrodes 11 and the metallic drive roller 16a are encircled with a protective frame, which is omitted from illustration here by reason of

a limited space. When the corona discharge is effected in the air, it emits O_3 and NO_x , which have adverse effects on the health of the operator. The room in which the treatment is performed, therefore, must be furnished with a duct 19
5 extended to the exterior of the room so that the air therein may remain clean at all times. Alternatively, the protective frame mentioned above may be substituted by a protective box which is adapted to ventilate the room interior.

Although the electrode 11 to be used in the electric
10 discharge treatment can be made in various shapes, it is desired to be composed of a multiplicity of wires bundled at the upper end as illustrated in Fig. 4. By forming the electrode 11 with a multiplicity of wires as described above, the electrode tends to discharge electricity through the
15 leading ends (edge parts) thereof during the course of discharge. Accordingly, this electrode is effective in enlarging the area of discharge, preventing the concentration of discharge on the corner parts or edge parts, and ensuring improvement of the surface modification of the coating film.
20 The unit diameter of the wires, the quantity thereof, and the positions of their leading terminals can be suitably adjusted in accordance with the cross-sectional shape, size, etc. of the profile subjected to the electric discharge treatment. In the case of the standard aluminum profile, it is desirable
25 that the unit diameter of the wires be not more than 1 mm, preferably in the range of 0.1 - 0.7 mm, and the quantity thereof be not more than 100. Optionally, the component wire may be formed by intertwining still thinner wires. In this

case, since the leading terminal parts of the wires come apart and expose the leading terminal parts of a greater number of thinner wires, they allow easy discharge of electricity. Further, since the component wires are further endowed with
5 elasticity, they are at an advantage in resuming their original shape perfectly after the electric discharge treatment which is performed while they are sliding in a bent form on the surface of the profile.

As the material for the electrode, aluminum, stainless
10 steel, iron, copper, etc. may be used either in a form devoid of a coating or in a form lined with such a dielectric material as silicone rubber.

In the practical surface modification of the aluminum profile, as shown in Fig. 5, a plurality of electrodes 11 are
15 arranged in the transverse direction of the profile at a predetermined interval depending on the width of profile or the like so that the surface modification of the whole surface of the aluminum profile may be carried out.

The aluminum profile 1 which has been subjected to the
20 surface modification by the corona discharge treatment as described above is then subjected to the local electric discharge treatment which is performed to the both sides of the aluminum profile, on which the edge parts of the sheet material are to be laminated, by means of a pair of right and
25 left local electric discharge treatment devices 20, as shown in Fig. 5. As these local electric discharge treatment devices 20, unlike the above-mentioned corona discharge treatment, the electric discharge treatment device having the

same structure as that of the electric discharge sheet cutter to be described hereinafter is used for the purpose of increasing the surface modification effect. However, the degree of convergence of a plasma beam can be adjusted.

5 Then, the aluminum profile 1 having the sheet material 41 laminated thereon as described above is sent to the automatic sheet cutting unit 50 and the sheet material 41 is cut by the electric discharge cutting treatment at a position between the aluminum profiles 1 by means of electric discharge
10 sheet cutters 51 to form the sheet-laminated aluminum profile 1a. The schematic structure of this electric discharge sheet cutter 51 is shown in Fig. 6.

 The electric discharge sheet cutter 51 has a cup-like housing 52 of a plastic provided at one side thereof with a
15 working gas introduction pipe 53 for supplying a working gas, such as air and argon gas. A nozzle pipe 54 of ceramics is coaxially and fixedly fitted in an opening of the housing 52. The housing 52 is provided in the central upper part thereof with a pin electrode 55 made of a conductive metal such as,
20 for example, copper. The tip of the pin electrode 55 is projected into the nozzle pipe 54. A ring electrode 56 made of a conductive material and having an opening 57 is attached to the lower end of the nozzle pipe 54. The ring electrode 56 is grounded and a high frequency voltage of the magnitude
25 of about 5-30 kHz, for example, 20 kHz, is applied between this ring electrode 56 and the pin electrode 55 by means of a high frequency generator 58.

 Since the working gas introduction pipe 53 is

eccentrically attached to the housing 52, the supplied working gas flows through the inside of the nozzle pipe 54 spirally and is gathered by the opening 57 used as a lower end outlet. As a result, the stable vortex of gas is formed and the core of the vortex is extended along the axis of the nozzle pipe 54.

Therefore, when a high voltage of high frequency of about 10-30 kV is applied between the ring electrode 56 and the pin electrode 55, the arcing from the pin electrode 55 to the ring electrode 56 is ignited. When air is used as the working gas, the arc "A" which emits bluish light generates. The arc extends from the tip of the pin electrode 55 to the approximately center of the opening 57 along the axis of the nozzle pipe 54 and branches at this point in the radius direction so as to extend to the ring electrode 56. At the branching point of this arc "A", when air is used as the working gas, the source of the "flame" which emits golden light weakly is formed and the so-called plasma beam "B" composed of charged particles, such as electrons and positive and/or negative ions, neutral atoms, the molecule radicals, the photons emitted and the like, is generated. This plasma beam "B" is used to cut the sheet material 41 at a position between the above-mentioned aluminum profiles 1.

In this method, the plasma arc "A" extends from the tip of the pin electrode 55 to the ring electrode 56 substantially in the axial direction of the nozzle pipe 54, i.e. in parallel with the flow of the working gas. Accordingly, the strong directive plasma beam "B" converged comparatively sharply is

emitted from the opening 57 of the ring electrode 56. By suitably setting the distance between the tip of the pin electrode 55 and the opening 57 of the ring electrode 56, the degree of convergence of the beam can be adjusted as needed.

5 Another advantage of this method is being able to perform the electric discharge treatment containing actually no ozone.

The above-mentioned electric discharge sheet cutters 51 are used as a pair and, as shown in Fig. 7, respectively moves to right and left from the upper part of the aluminum profile 10 1 having the sheet material 41 laminated thereon so that the whole sheet material may be cut by the irradiation with a plasma beam in a transverse direction.

After the sheet material 41 is laminated on one surface of the aluminum profile 1 as described above, if necessary, 15 the sheet material 41 may be again laminated on the other surface of the aluminum profile 1 according to the process described above, and then the electric discharge cutting of the sheet material at a position between the profiles can be performed. By this method, the sheet-laminated aluminum 20 profile 1a having the sheet materials 41 laminated on the whole surface of the aluminum profile 1 as shown in Fig. 8 is manufactured.

Although the preferred embodiments of the present invention has been described above, the present invention is 25 not limited to the above-mentioned embodiments. For example, although the manufacture of the sheet-laminated aluminum profile has been described with reference to a preferred embodiment capable of continuously performing a

series of steps of the surface modification of the coated aluminum profile, the lamination of the sheet material, the automatic cutting of the sheet material by the electric discharge cutting treatment, and the discharge of products, 5 the aluminum profile which has undergone the anodic oxidization treatment or further the sealing of the anodic oxide film can be directly subjected to the sheet material lamination step, without subjecting to the surface modification by the above-mentioned electric discharge 10 treatment. The described embodiments are therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description and all changes which come within the meaning and the range 15 of equivalency of the claims are, therefore, intended to be embraced therein.